Celery

ATLANTIC PROVINCES VEGETABLE CROPS GUIDE TO PEST MANAGEMENT 2002 - 2003

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Introduction

Celery is a member of the Umbelliferae (carrot family) *Apium graveolens* and is an erect strong smelling biennial (botanically) 30 to 60 cm tall. It is native to the British Isles and is a widespread native of temperate Europe growing in damp places especially near the sea. Cultivation probably originated in the Mediterranean area. Greeks and Romans used it only as a medicine 2000 years ago. In 1623 the use of celery as a food crop was recorded. Since then the crop has been improved by more fleshy leaf stalks to give the succulent vegetable we know today.

Celery production is best in a cool, humid and long growing season with an ample and uniform supply of moisture. Germination occurs at a minimum temperature of 5°C with an optimum range of 15 to 21°C, an optimum temperature of 21°C and a maximum temperature of 30°C. Optimum growth occurs at soil and air temperatures of 12 to 16°C. Exposure to cold (2 to 4°C) for 10 to 15 hours will initiate a flowering process. Even temperatures from 5 to 10°C for 10 days will promote seed stalk formation. Celery plants for transplants should be grown above 16°C. This crop will withstand light frosts in the fall but is damaged by several moderate freezes.

Well drained peat with a high water table is optimum for celery production. Satisfactory crops can be produced on fertile, medium textured mineral soils with high organic matter under irrigation. Most of the celery root system is with the top 15 cm of soil but some roots penetrate as deep as 2 feet. Clay soils are generally unsuitable.

Celery can be produced in tunnel houses for early or late markets (early July to late August and from October into November respectively). Main crop celery can be produced from mid August to late October depending on the microclimate. Yields of 30,000 to 50,000 kg per hectare are possible where growing conditions are favourable.

In terms of markets only green cultivars are commercially acceptable unless there are speciality markets for yellow or blanched cultivars. Currently little celery is produced in the Atlantic area. It has become an important crop because of the growth in salad vegetables so consumption is on the increase. It is also a vegetable that has a reasonably high per capita consumption. There would seem to be opportunity to produce this crop for wholesale and retail markets. It has not been determined if there is any processing market potential for this crop.

Nutrient Content: Contains fair amounts of several nutrients including Vitamin A, potassium and sodium. Very low in calories - 1 stalk contains 5 kilocalories.

Crop Establishment ▲ to Top

Seed Treatment - Three year old seed should be used to ensure the absence of viable leaf blight disease on seeds. Otherwise it must be hot-water-treated. "Primed" seed may be available and coated seed may be available.

Seeding/Planting - Growing transplants - sow seed 10 to 12 weeks before field planting (usually in mid June). Approximately 150 to 200 grams of seed provide enough plants for 1 hectare (75,000 to 135,000 plants) when the standard field spacing is used (seedlings are pricked out at 4 to 5 weeks). Until the plants emerge a temperature of 21 to 24°C is suitable. Then 18 to 24°C is ample for steady growth. Night temperatures should not dip below 13°C to lessen the production of "bolters".

Plants for the early crop should not be set in the field until the danger of a prolonged cool period or actual freezing is over.

If the plants have become too tall and spindly before field setting they can be clipped back to a height of 12 to 15 cm. Clipped plants facilitate transplanting but well grown, untrimmed plants are preferable because they receive less check in growth.

Outdoor seedbeds may not be a feasible way to produce transplants in this area due to the short season.

Field Transplanting - The usual field spacing is 15 to 20 cm between plants in rows 60 to 100 cm apart or in paired rows 20 cm apart with 60 to 100 cms between pairs.

Crop Management

For succulent and tender stalks, high soil moisture is necessary. Water must be regularly supplied at frequent intervals and more moisture is needed in the last month before harvest as the most rapid growth occurs at this time. About 75 cm of water are required to grow the crop to maturity.

Cultivation or hand hoeing may be necessary depending on the weed problems. Plastic mulches may be used to control weeds in some systems of production.

Nutrition

ALL ADDITIONS OF LIME AND FERTILIZER OR MANURES SHOULD BE BASED ON RECOMMENDATIONS FROM A SOIL TEST.

Celery is a heavy feeder and a poor forager so on all but the richest soils large quantities of nutrients should be applied.

Manure - Where manure is available its use is recommended. Up to 100 tonnes per hectare may be applied but watch that nitrogen levels are kept under control.

Lime - Lime should be applied to maintain the soil pH in the range 6.0 - 6.8 (preferably above 6.5). Lower pH levels are tolerated on peat soils.

Nitrogen - Celery has a high nitrogen requirement. Generally, apply two-thirds of the nitrogen at planting time and the remainder sidedressed in 2 to 3 applications as required. Consider the nitrogen in legume sod and manure applications since blackheart can be aggravated by high available nitrogen levels.

Phosphorus - This fertilizer is usually broadcast preplant in moderate applications.

Potash - Sandy loam soils may be low in potash. On these soils incorporate the potash preplant. Reduce the rate of potash if it is side banded.

Magnesium - Ratios of potassium to magnesium should be reduced by using dolomitic limestone. Deficiencies may also be corrected by spraying with magnesium sulphate at 10 day intervals (10 to 15 kg per hectare).

Calcium - "Black heart" a sign of calcium deficiency, may be avoided with use of calcium nitrate and/or calcium chloride applications. Spray directly into the heart of the plant 2.2 to 4 kg calcium (from calcium chloride) or 1.2 to 3.4 kg calcium (from calcium nitrate) per 1000 L of water. If celery is under moisture stress, humidities are high, or the crop is growing rapidly, repeat once per week.

Sulfur - Is suggested on sandy soils low in organic matter.

Micronutrients - Boron - "Stem cracking" is a sign of boron deficiency. It can be prevented by applying 0.2% boron in the fertilizer and/or later in the growing season as a foliar spray (4 kg per hectare of Solubor in sufficient water for coverage

along with a "spreader" when plants are about 15 cm tall).

Salt (NaCl) - This is used in some growing areas to increase yields. This should be ploughed into the soil at least a month before transplanting.

Manganese - On soils with a pH of over 6.5 this nutrient may not be available to the plant. Spray with manganese sulphate at 9 kg per hectare.

Application Method - broadcast before planting and incorporate part of the nitrogen, potash and salt. Band, if possible, phosphorus, small amounts of nitrogen and small amounts of potash.

Pests and Pest Control ▲ to Top

Weeds

Perennial weeds should be controlled prior to planting. Herbicidal oil can be used to control annual broadleaf weeds in the seedbed. Herbicides can be applied 8 to 10 days after transplanting to control germinating annual weeds.

Diseases

Damping-Off (fungi)

Characteristics: Damping-off causes an early collapse of young seedlings.

Control: Grow seedlings in sterilized soil. Treat seed with fungicide before seeding, or drench immediately after seeding. Do not overwater or crowd seedlings.

Leaf Blight (fungi)

Characteristics: Leaf blights are commonly caused by either one of two fungi, *Cercospora* or *Septoria*. Both overwinter on and in seed and in debris from diseased plants. These diseases are spread by wind, rain splash and movement of workers or implements in the field. *Cercospora* can be recognized first by yellow spots on both sides of the leaves which enlarge rapidly and become ash gray. *Septoria* shows as a yellowish speckling, later turning yellowish gray. Very small black specks (fungus fruiting bodies) are associated with, and usually within, the spots. Each disease can affect petioles as well as leaves.

Control: The fungi are seed and soil borne. Every effort should be made to produce disease-free seedlings (grown in sterilized soil using 3 year old seed or hot water treated seed). Begin spraying when seedlings are 5 cm high and continue weekly throughout the season.

Pink Rot (fungi)

Characteristics: Plants wilt and collapse in the field due to watery, pinkish rot of crown and petioles. The disease is caused by *Sclerotinia* . Under wet conditions,

decayed areas may be covered with a white mold which develop hard, black pea-sized fungal structures.

Control: Following other crops in rotation such as clover, soybeans, carrots, beans, lettuce and cole crops increases risk of disease. Always plow under field debris immediately after harvest.

Yellow (fungi)

Characteristics: Fusarium yellows has not been reported in the Atlantic region but is a serious disease in other growing areas. The fungus infests the plants through the root system. A brown discoloration occurs in the vascular system. The outer leaves become yellow and spreads to other leaves as the fungus progresses through the vascular system. Eventually the foliage turns brown and dies.

Control: Grow resistant or tolerant varieties. Practice a 2 to 3 year rotation. Do not include carrots, cabbage or sweet corn in the rotation. Weeds also maintain or increase disease levels in the soil. Avoid transplants from infested areas.

Aster Yellows (mycoplasma)

Characteristics: Plants are light yellow with elongated, twisted leaves. Later the plants become yellow and dwarfed and the petioles become brittle and frequently crack. Spread by leaf hoppers.

Control: Control weeds that harbour the organism and control leaf hoppers.

Tarnished Plant Bug

Characteristics: A serious insect pest, often causing complete crop loss. Adults are small (6 mm) insects that vary from straw-green to dark brown with yellowish, reddish-brown and black mottling. Adults are very active, quickly flying away when disturbed. They overwinter under bark or leaf-litter, emerging early in the spring and feeding on weeds and fruit buds. After mating, eggs are laid on stems and petioles. Nymphs (yellowish-green, 1 mm long) emerge after 10 days, undergoing two molts to become adults within 3 to 4 weeks. Adults and nymphs are equally damaging, their feeding distorts stalks, often causing breakdown resembling black heart.

Control: Controls for aster (six spotted) leafhopper will also be effective against this insect. Clean cultivation of weeds adjacent to the crop area will also help to reduce pest numbers.

Aster (Six-spotted) Leafhopper

Characteristics: Leafhoppers are small (4 mm long), slender, wedge-shaped insects; they are greenish-yellow in color. They can occur in large numbers throughout the season. Leafhoppers transmit aster yellows disease.

Control: Apply 3 to 4 sprays at 10 day intervals beginning early July. Also spray weeds in headlands and control leafhoppers on adjacent carrots and lettuce (other vegetable and field crops are hosts).

Aphids

Characteristics: Aphids are small, soft-bodied, slow-moving insects. They are often found in large colonies on the undersurface of leaves. A colony consists of winged and wingless adults and various sizes of nymphs. Aphids may be black, yellow or pink, but mostly are various shades of green. Aphids feed by sucking plant sap. Saliva injected while feeding may carry plant viruses or may be toxic to the host plant. Feeding of large numbers of aphids discolors the plant foliage and curls the leaves. The plants may be covered with a sticky substance, honey dew, which is excreted by the aphids.

Control: Apply recommended pesticides when aphids are numerous.

SPECIFIC CHEMICAL CONTROLS FOR THE VARIOUS CROP PESTS DISCUSSED MAY BE FOUND IN THE ATLANTIC PROVINCES "GUIDE TO PEST MANAGEMENT" FOR VEGETABLE CROPS.

Harvesting and Handling ▲ to Top

Celery may be harvested as soon as it reaches marketable size. Early celery can be harvested before it is full grown if high market price for early cropping justifies it. Cut the stalks below ground level with a sharp blade. Trim off outer leaves and pack in crates.

On a large production scale this crop is machine harvested. It is then washed, trimmed and packed in a receiving shed. Sometimes leaves trimmed are used for processing into soups or dried herb mixes.

Storage and Conditioning ▲ to Top

Celery can be stored 1 to 2 months at a temperature of 0 to 1°C and 98 to 100% relative humidity. The freezing point is -0.2°C. Celery is highly perishable, and when warm and wet it decays rapidly. Precooling is essential and is usually accomplished by hydrocooling forced-air or vacuum.

Store celery in a room free from strong odours since the plant absorbs foreign flavours. Laborers should wear rubber gloves as severe skin rashes can occur in some individuals. Packaging in well ventilated plastic is frequently used to protect it from wilting.

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Horticulture Section, Production Technology Branch, Nova Scotia Department of Agriculture & Marketing
on behalf of APASCC and members:

PEST	PESTICIDE (Formulation)	RATE Product	DAYS TO HARVEST	REMARKS ▲ to Top
Weeds ▲ to Top				
Preplant Perennial Weeds including quackgrass	ROUNDUP 356 Sn	2.5 to 7.0 L/ha	-	Apply in the fall or spring prior to planting. Annual weed control programs will be necessary to control weeds germinating after planting. For quackgrass control apply to actively growing quackgrass when at least 4 new leaves are present. The low rate (2.5 L/ha) will provide a minimum of one season control, while higher rates (4.75 to 7 L/ha) will provide longer term control. The low rate of Roundup should be applied in 50 to 100 L/ha water. If higher water volumes are used add a suitable surfactant. Wait 72 hours before plowing under. Best control of quackgrass is obtained when these herbicides are applied in the fall.
	TOUCHDOWN 480	2.5 to 7.0 L/ha	-	
	GLYFOS	2.5 to 7.0 L/ha	-	
	ROUNDUP TRANSORB	2.5 to 7.0 L/ha	-	
Post-emergence treatments Seedling annuals	HERBICIDAL OIL (Weedkiller No. 1)	600 to 800 L/ha (overall spray) 300 to 400 L/ha (rows only)	-	Apply herbicidal oil undiluted. Use only on outdoor seedbeds, and only if soil is moist. Apply as first true leaves of crop develop and before weeds are 10 cm high.
	AFOLAN F 480 Su	1.9 to 4.7 L/ha	-	Should be applied 8 to 10 days after transplanting. Some temporary yellowing may occur.
	GESAGARD 80 WP	2.25 to 2.75 kg/ha	-	Apply to transplanted celery only, 7 to 14 days after transplanting and before weeds reach 5 cm in height.
Stale Seedbed Technique	REGLONE L	2.7 to 5.5 L/ha	-	Apply before crop emergence to foliage of emerged weeds.
	GRAMOXONE L	2.7 to 5.5 L/ha	-	
Insects ▲ to Top				
Aster leafhopper	SEVIN 85 WP	0.6 to 1.3	3	Aster leafhoppers spread aster yellows. Apply 3 to 4

		kg/ha		sprays at 10 day intervals beginning early July. Also spray weeds in headlands and control leafhoppers on adjacent carrots and lettuce. Discontinue sprays 20 days before harvest.
	SEVIN 50 WP	1.1 to 2.2 kg/ha	3	
	SEVIN XLR 43 Su	1.3 to 2.5 L/ha	5	
	SEVIN L 420 Su	1.25 to 2.5 L/ha	3	
	MALATHION 500 EC	2 L/ha	7	
	MALATHION 25 WP	4.5 kg/ha	7	
	CYMBUSH 250 EC	140 ml/ha	7	
Tarnished plant bug	THIODAN 4 EC	2 L/ha	14	Cymbush and Sevin used for aster leafhoppers will give some control. Trim celery at harvest.
	THIODAN 50 WP	1.75 kg/ha	14	
	ORTHENE 75%	0.75 to 1.1 kg/ha	21	Do not re-enter sprayed area until product has dried.
Aphids	MALATHION 25 WP	4.5 kg/ha	7	Apply if aphids are plentiful. Trim celery at harvest.
	THIODAN 4 EC	2.0 L/ha	14	
	ENDOSULFAN 50 WP	1.7 kg/ha	14	
	THIODAN 50 WP	1.7 kg/ha	14	
	LAGON 480 EC	700 ml/ha	3	Do not apply more than 4 applications per growing season.
	DIBROM EC	1.1 to 1.65 L/ha	4	
	ORTHENE 75%	0.75 to 1.1 kg/ha	21	Do not re-enter sprayed area until product has dried.
Diseases				▲ to Top
Damping off	THIRAM 75 WP	1.5 kg/1000 L	7	Apply in 70 to 105 L of water per 100 m^2 when seedlings first emerge and repeat at weekly intervals.
	CAPTAN 50 WP	125 to 225 g/100 m^2	-	Use as a dust treatment to soil or in 50 to 85 L of water per 100 m^2. Work into the upper 8 to 10 cm of soil before planting.
	CAPTAN 80 WP	1.5 kg/1000 L	-	Apply 50 to 85 L per 100 m^2. Work into upper 7.5 to 10 cm of soil before planting.
	MAESTRO 75 DF	1.5 kg/1000 L	-	
Early and late blight	BRAVO 500 F	2.4 to 4.0 L/ha	7	Begin spraying when seedlings are 5 cm high and repeat at 7 day intervals. Apply Bravo at 8 to 10 day intervals. Use hot water treated seed and sterilized soil, flats, etc.
	DITHANE 75 DG	2.25 kg/ha	14*	
	PENNCOZEB	2.25 kg/ha	14*	

75 DF			* **Wash and trim celery.**
DITHANE M-45 80 WP	2.25 to 3.25 kg/ha	14*	
MANZATE 200 80 WP	2.25 to 3.25 kg/ha	14*	
MANZATE 200 75 DF	2.25 to 3.25 kg/ha	14*	
MANEB 80 WP	1.1 to 3.25 kg/ha	14*	
DITHANE M-22 80 WP	1.1 to 3.25 kg/ha	-	
ZINEB 80 WP	1.1 to 3.3 kg/ha	14*	
POLYRAM 80 DF	2.25 to 3.25 kg/ha	14	
DYRENE 50 WP	2.25 to 3.75 kg/ha	1*	
FIXED COPPER	manufacturer's directions	1	